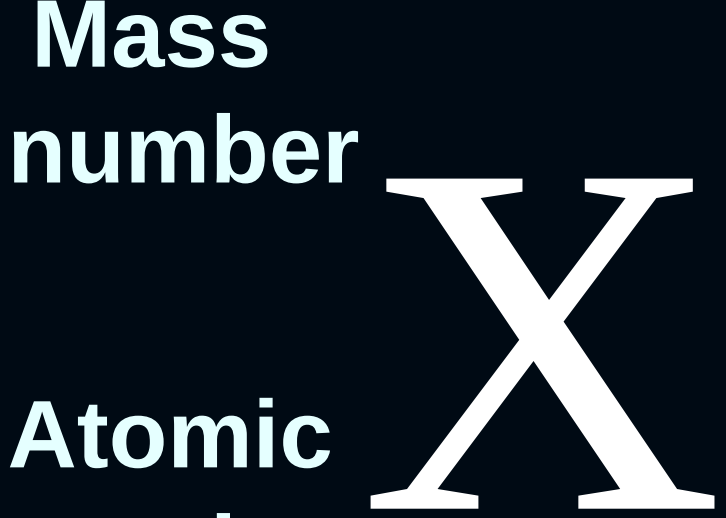
History of the Atom

Complete the pdf file in the homework section of the class webpage "History of the Atom".

It will be due Monday the 2nd 2015

Bell Work
2-Oct-15

What is the generic symbol of an atom and its components?



Objective

Finish Chemical and Physical Properties Lab

Science Fair Process and Due Dates

EQ: How could a conceptual understanding of the interactions between atoms help further your understanding of our universe?

Turn In, 2.Oct.2015

Dimensional Analysis Recall

A thought on the atom & our universe by Neil deGrasse Tyson

The most astounding fact

http://youtu.be/9D05ej8u-gU

Recall…

What is the scientific method?

List the part and them describe.

The Scientific Method

Ask a question

Research the Question

Form a hypothesis

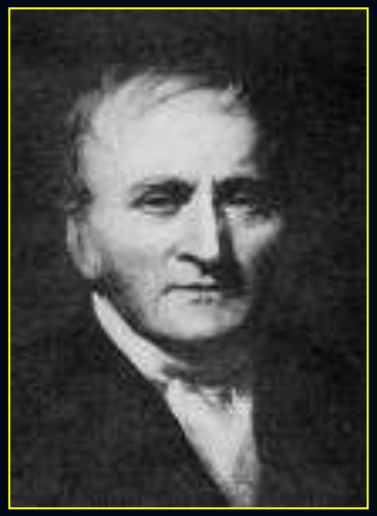
Test hypothesis through an experiment

Analyze data and form a conclusion

Communicate your results

Dalton's Atomic Theory (experiment based!)

1) Elements are composed of tiny indivisible particles called atoms
2) Atoms of the same element are identical. Atoms of any one element are different from those of any other element.



John Dalton
(1766 – 1844)

Dalton's Atomic Theory (experiment based!)

3) **Atoms of different elements combine in simple whole-number ratios to form chemical compounds**
4) **In chemical rxns, atoms are combined, separated, or rearranged – but never changed into atoms of another element.**

John Dalton (1766 – 1844)

Bell Work
5-Oct-15

Using your knowledge of the atom, how would YOU describe an atom?
Give at least three (3) specific points for your description. In complete sentences, as a short paragraph response.
In addition you may draw what you think an atom looks like.

EQ:

How does hard work pay off for some and not others?

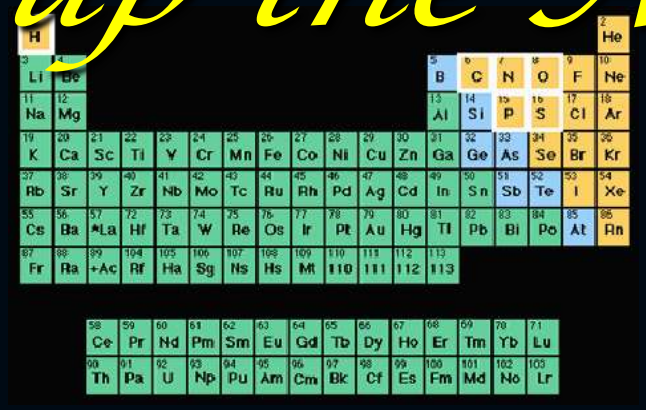
OBJECTIVES:

Size up an atom

Turn In
5Oct15

Period 2 and 3 turn in "Physical and Chemical Changes Lab"

Sizing up the Atom

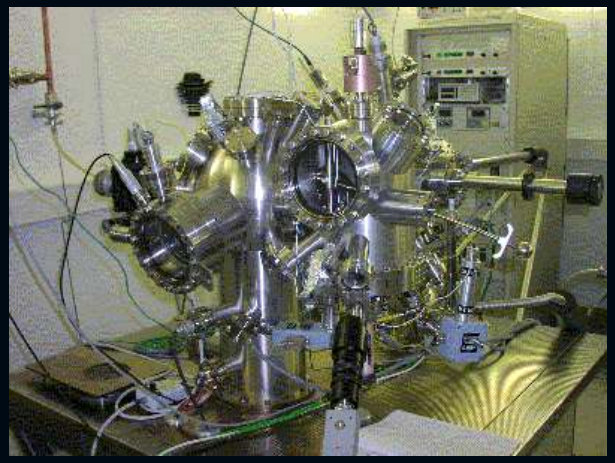


Elements are able to be subdivided into smaller and smaller particles – these are the *atoms*, and they still have properties of that element

Sizing up the Atom

If you could line up 100 000 000 Cu atoms in a single file, they would be approximately *1cm long*

Despite their small size, individual atoms are observable with instruments such as *scanning tunneling (electron) microscopes (SEM)*



Size of the Atom

If the diameter of an atom is 100 000x larger than the diameter of its nucleus, what is the diameter, in meters, of an atom that has a nucleus **0.1cm** in diameter?

How to really see this

We are going to the field to look at the size of he electron cloud compared to the nucleus!

Bell Work
6-Oct-2015

What experiment was used to determine the presence of the electron?

Explain/ Describe in detail the apparatus used?

EQ:

How does hard work pay off for some and not others?

OBJECTIVES:

Be able to describe the finding and experiment for the discovery of the electron.

Structure of the Nuclear Atom

One change to Dalton's atomic theory is that atoms are divisible into subatomic particles:

Electrons (e^-),

protons (p^+),

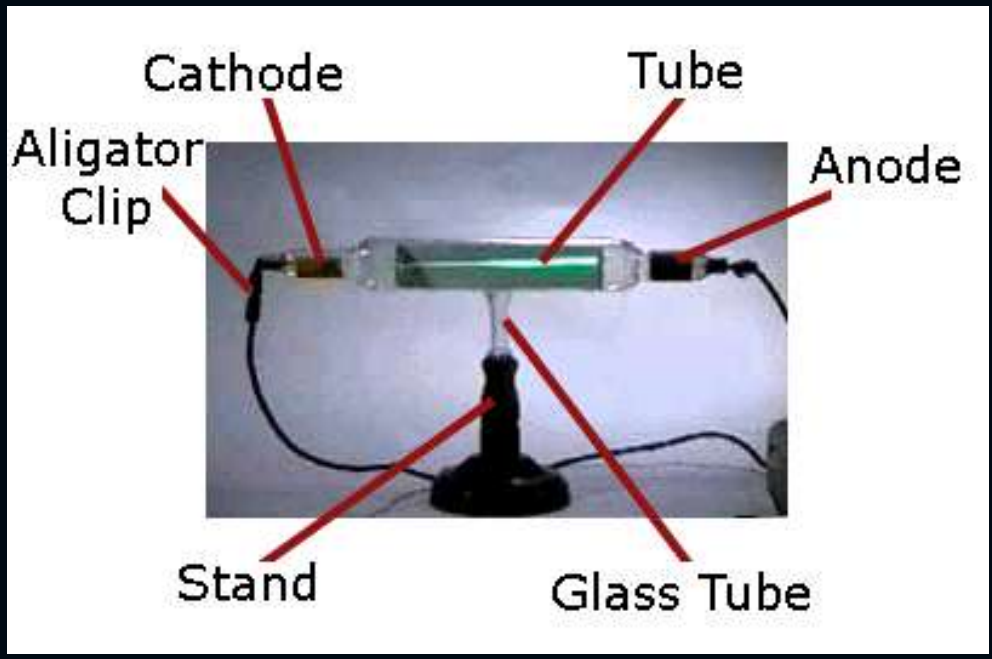
neutrons(n^0)

are examples of these fundamental particles

There are many other types of particles, but we will study these three (3)

Discovery of the Electron (e^-)

In 1897, J.J. Thomson used a *cathode ray tube* to deduce the presence of a negatively charged particle: the electron (e^-)



Modern Cathode Ray Tubes

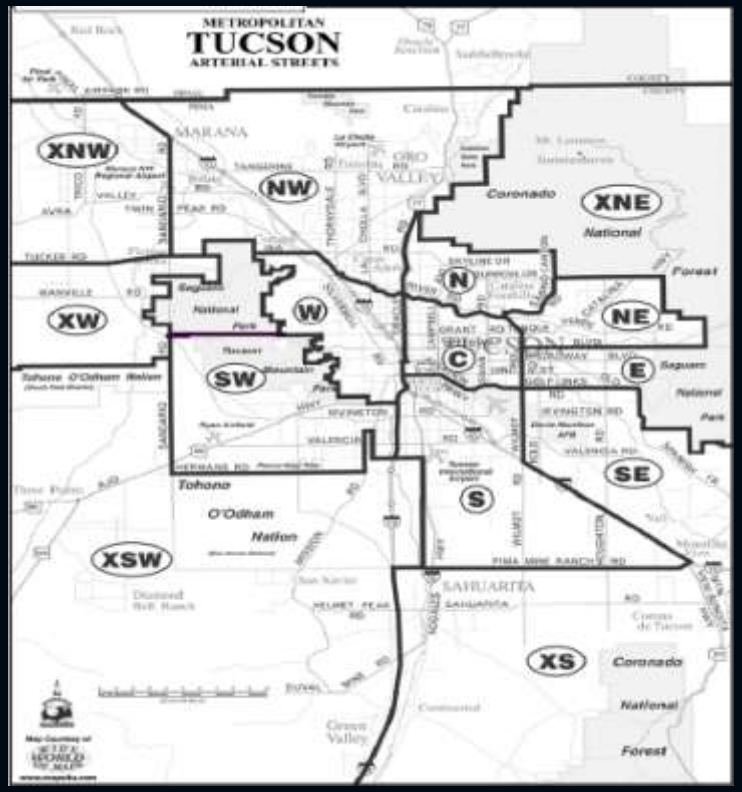
Television

Computer Monitor

Cathode ray tubes pass electricity through a gas that is contained at a very low pressure.

Mapping atomic structure

You will use a string and a meter stick to determine the diameter of one of four (4) different balls.

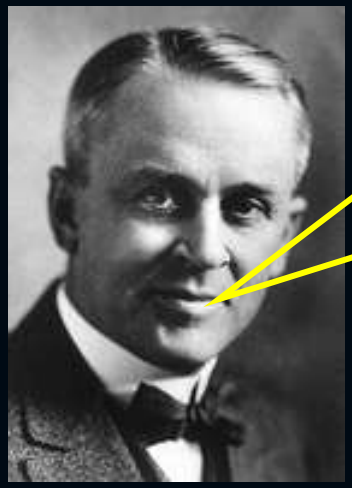


1.61 km = 1.00 mile

Then you will relate the diameter to the size of a nucleus and draw it on the map of Tucson.

Mass of the Electron

The oil drop apparatus



Mass of the electron is 9.11×10^{-28} g

1916 – Robert Millikan determines the mass of the electron: 1/1840 the mass of a hydrogen atom; has one unit of negative charge

http://youtu.be/XMfYHag7Liw

Conclusions from the Study of the Electron:

a) **Cathode rays have identical properties regardless of the gas (element) used . All elements must contain identically charged e^-.**

b) **Atoms are neutral, so there must be positive particles in the atom to balance the negative charge of the e^-**

$(p^+) + (e^-) = Charge$

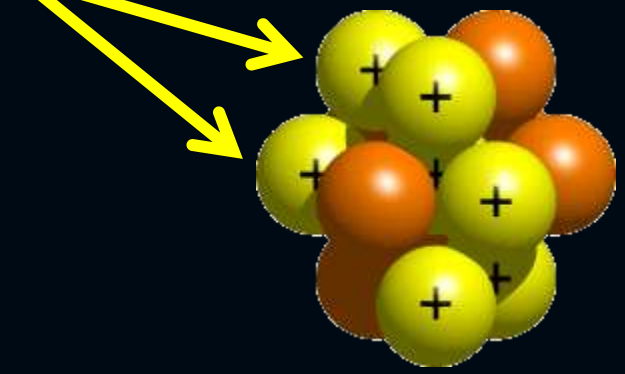
Conclusions from the Study of the Electron:

c) Electrons have so little mass that atoms must contain other particles that account for most of the mass

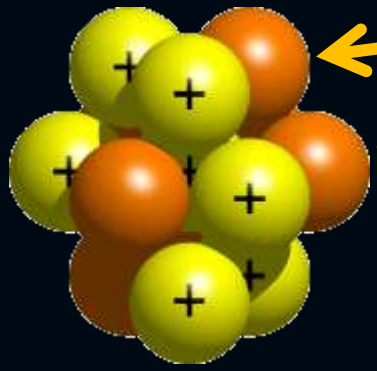
Conclusions from the Study of the Electron:

Eugen Goldstein in 1886 observed what is now called the "proton"(p^+). Particles with a positive charge, and a relative mass of 1 (or 1840 times that of an e^-).

Protons



Conclusions from the Study of the Electron:

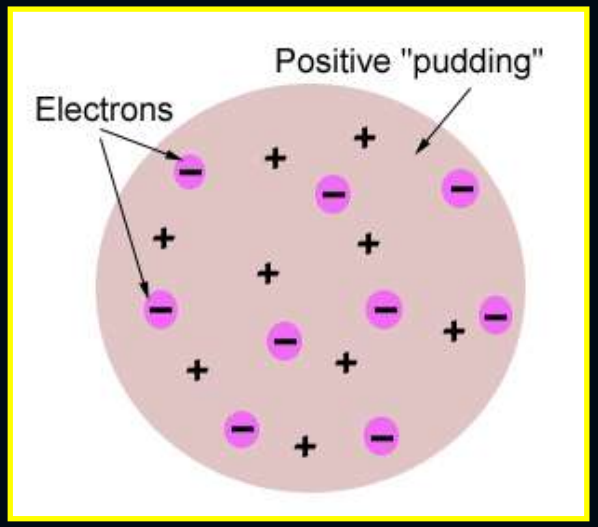


1932 – James Chadwick confirmed the existence of the "neutron" – a particle with no charge, but a mass nearly equal to a proton

OBJECTIVES:

- Explain where the mass of an atom and the bulk of the volume are located in an atom
- See relative size of an atom: nucleolus

Thomson's Atomic Model



J. J. Thomson

Thomson believed that the e^- were like plums embedded in a positively charged "pudding," thus it was called the "plum pudding" model.

Bell Work
7-Oct-2015

What were three (3) important findings from the gold foil experiment?

Who carried out the experiment?

EQ:

How does hard work pay off for some and not others?

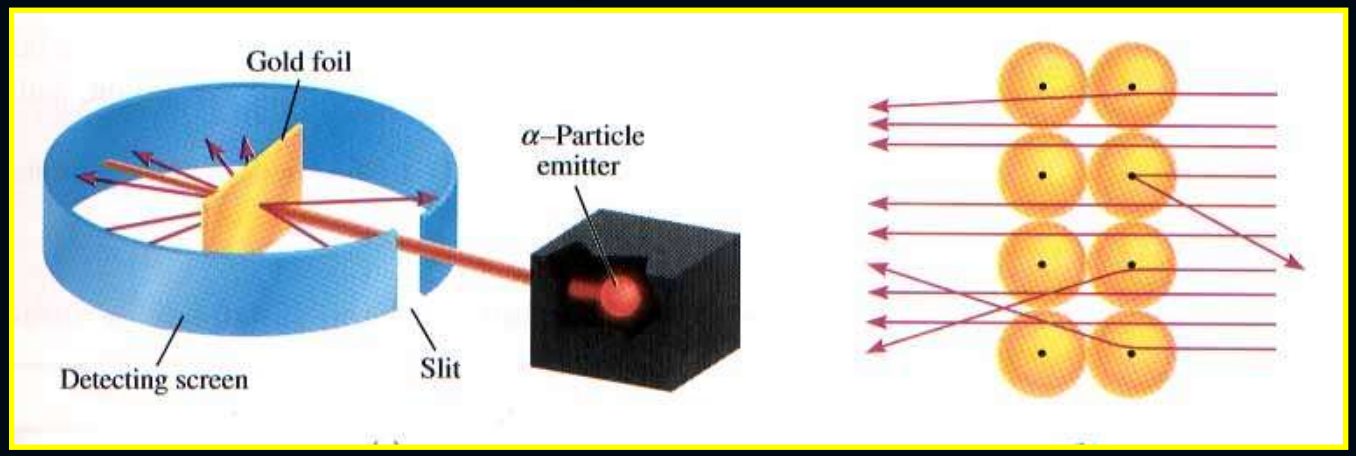
OBJECTIVES:

Be able to describe the finding and experiment for the discovery of the nucleus.

Subatomic Particles

Particle	Charge	Mass (g)	Location
Electron (e^-)	-1	9.11×10^{-28}	Electron cloud
Proton (p^+)	+1	1.67×10^{-24}	Nucleus
Neutron (n^o)	0	1.67×10^{-24}	Nucleus

Ernest Rutherford's Gold Foil Experiment - 1911



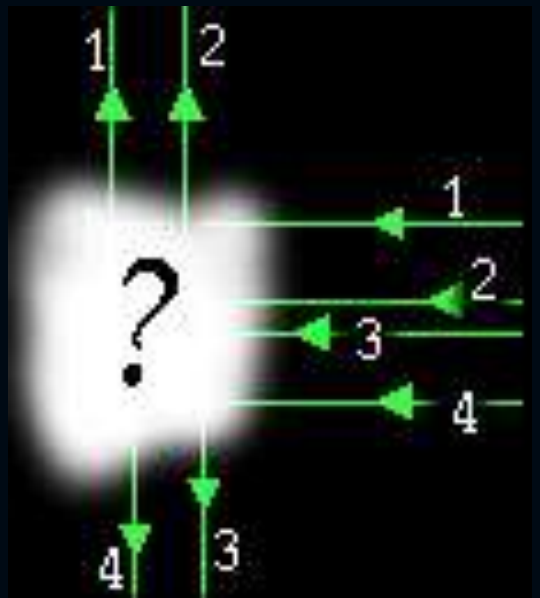
- **Alpha particles are He nuclei - The alpha particles were fired at a thin sheet of gold foil**
- **Particles that hit on the detecting screen (film) are recorded**

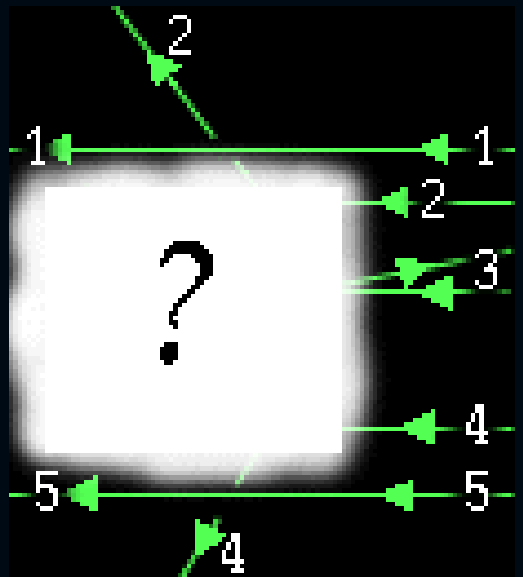
http://micro.magnet.fsu.edu/electromag/java/rutherford/

Rutherford's problem:

In the following pictures, there is a target hidden by a cloud. To figure out the shape of the target, we shot some beams into the cloud and recorded where the beams came out. Can you figure out the shape of the target?

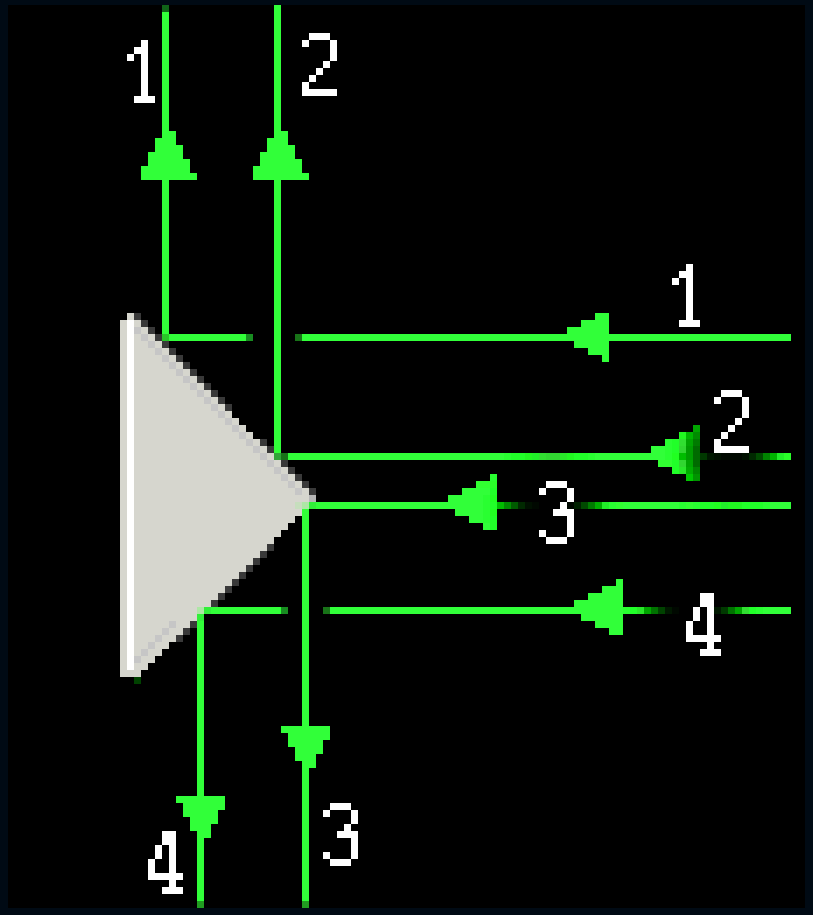
Target #1



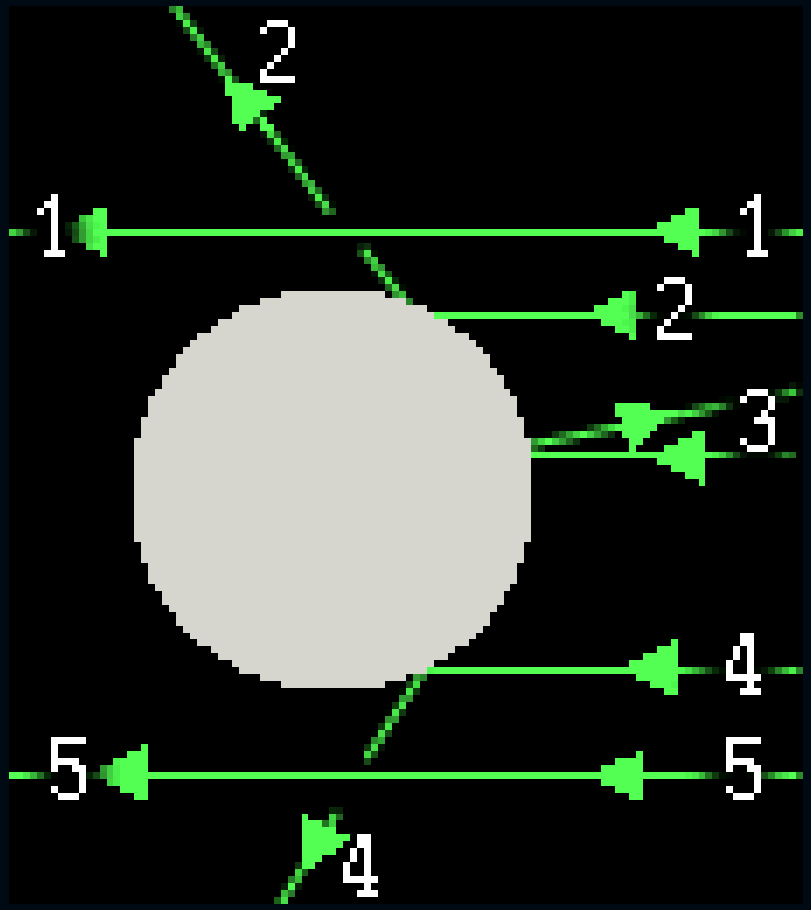


Target #2

The Answers:



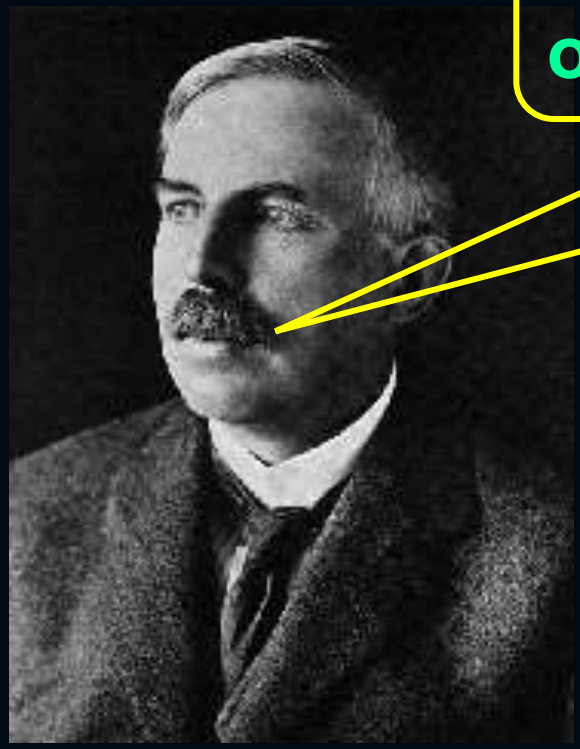
Target #1



Target #2

Rutherford's Findings

Most of the particles passed right through
A few particles were deflected
VERY FEW were greatly deflected



"Like howitzer shells bouncing off of tissue paper!"

Conclusions:

a) **The nucleus is small**
b) **The nucleus is dense**
c) **The nucleus is positively charged**

The Rutherford Atomic Model

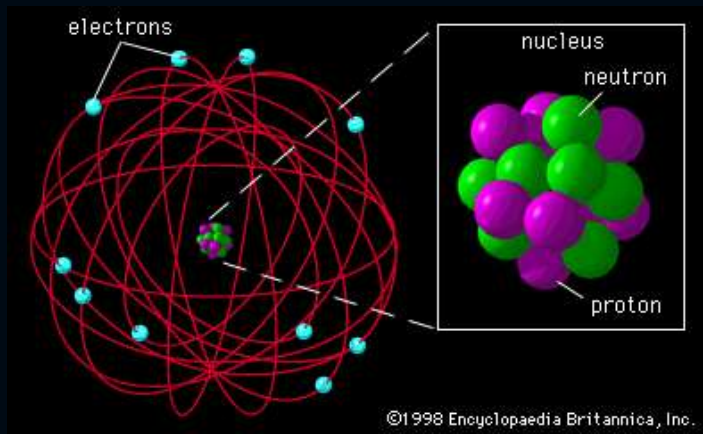
Based on his experimental evidence:

- **The atom is mostly empty space**
- **All the positive charge, and almost all the mass is concentrated in a small area in the center. He called this a "nucleus"**

The Rutherford Atomic Model

Based on his experimental evidence:

- **The nucleus is composed of protons and neutrons (they *make* the nucleus!)**
- **The e^- distributed around the nucleus, and occupy most of the volume**
- **His model was called a "nuclear model"**



Atomic Number

Atoms are composed of *identical* protons, neutrons, and electrons

- **How then are atoms of one element different from another element?**

…they contain different numbers of PROTONS

The "atomic number" of an element is the number of protons in the nucleus

 # protons in an atom = # electrons

Atomic Number

Atomic number (Z) of an element is the number of protons in the nucleus of each atom of that element.

Element	# of protons	Atomic # (Z)
Carbon	6	6
Phosphorus	15	15
Gold	79	79

Last Test of the Quarter

Time to rock it.
End of the period = turn your test in, No extra time ☺

destroyers-editorialsandreviews.blogspot.com

Bell Work
8-Oct.-2015

Come up with the following: **protons**, **neutrons**, and the **elements name**…

$^{107}_{46}Pd$ $^{45}_{21}Sc$ $^{23}_{11}Na$ $^{119}_{36}Kr$

EQ:

How does hard work pay off for some and not others?

OBJECTIVES:

Be able to determine number of protons, neutrons, and electrons then write the atomic symbol.

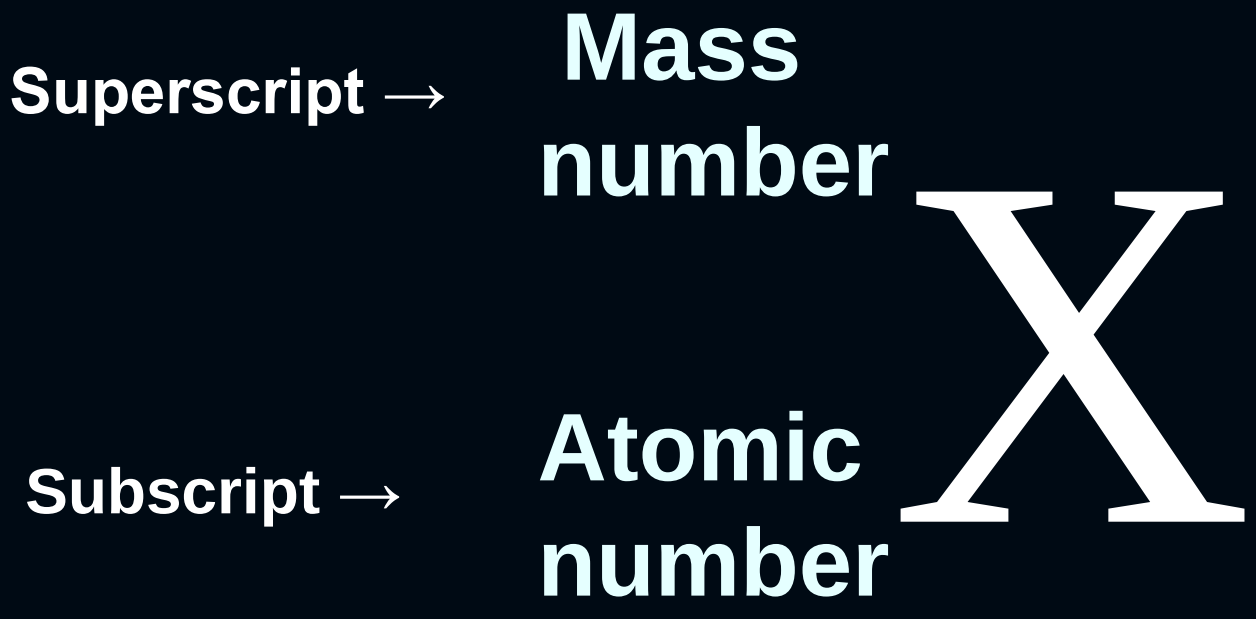
Mass Number

Mass number is the number of protons and neutrons in the nucleus of an isotope: Mass # = p^+ + n^0

Nuclide		p^+	n^0	e^-	Mass #
Oxygen	18	8	10	8	18
Arsenic	75	33	42	33	75
Phosphorus	31	15	16	15	31

Complete Symbols

Contain the symbol of the element, the mass number and the atomic number.



Symbols

Find each of these:

a) number of protons

b) number of neutrons

c) number of electrons

d) Atomic number

e) Mass Number

$$^{80}_{35}\mathbf{Br}$$

Symbols

Find each of these:

a) number of protons

b) number of neutrons

c) number of electrons

d) Atomic number

e) Mass Number

$$^{200}_{80}\mathrm{Hg}$$

Symbols

- If an element has an atomic number of 34 and a mass number of 78, what is the:

  a) number of protons

  b) number of neutrons

  c) number of electrons

  d) complete symbol

Symbols

- If an element has 91 protons and 140 neutrons what is the

  a) Atomic number

  b) Mass number

  c) number of electrons

  d) complete symbol

SYMBOLS

- If an element has 78 electrons and 117 neutrons what is the
  a) Atomic number
  b) Mass number
  c) number of protons
  d) complete symbol

Science Fair Due Date 8-Oct-2015

You and your partner, will type your names and project title on the Pre AP 2015/2016 Spread sheet doc and then turn in your Sci. Fair note book, I will return them to you tomorrow.

Due Dates:

What to Have Completed	Due
A. I. Topic/ Approval, II. Research/ Introduction, III. Hypothesis, and VI. Variables	8.Oct.2015
B. Experimental approval forms & VI. Materials List and VII. Data Collection Tables/ Charts	12.Oct.2015

Bell Work
9-Oct.-2015

What element am I?

184

74 **X**

Objective:

Clean lab, and finish atomic symbol practice

EQ: How does hard work pay off for some and not others?

Lab Clean up

Period 1.

Wash out all glass ware in “soiled” bin

Leave on North counter to dry

Lab Clean up

Period 2.

Put away clean glass

remove lab trays and inventory, leave inventory list out on tabel

Lab Clean up

Period 3.

- Stock lab trays with needed ware, put back in benches

Protons	Neutrons	Electrons	Charge	Symbol
1	0	1	0	H
1			1+	H
2	2		0	He
				Li
			1+	Li
				P
				Ca
				Br
				B
8	8	10	2-	O
6	6	6		C
				N
				Ar
47	60		1+	Ag
				Au
11	12	10		Na

Home Work

Make a table with all of the scientists we have talked about thus far and what they contributed to the discovery of the atoms and subatomic particles; leave a little room to add three (3) more scientist.

Read 101-103, Problem 12-13 on page 103 of book

Science fair

Research Plan

For each source:

Source: _____

a. Summery of info in source pertinent to your project

b. Specific info needed for your project

ex. Previous experiments, formulas, scientific law/ rules, material needed, instrumentation, dangers, confines, etc

Objective:

You will see the relationship between the size of an atom and it nucleolus

Warm up: Fill me Out

Nuclide	p^+	n^0	e^-	Atomic Symbol
Vanadium				
Actinium				
	49			
	51			
				^{154}Ho
Uranium				

Recap

What three properties of the nucleus can be deduced from the Rutherford scattering experiment? Explain your answer.

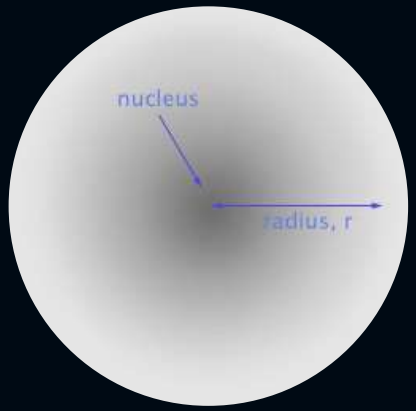
Hunt for 114

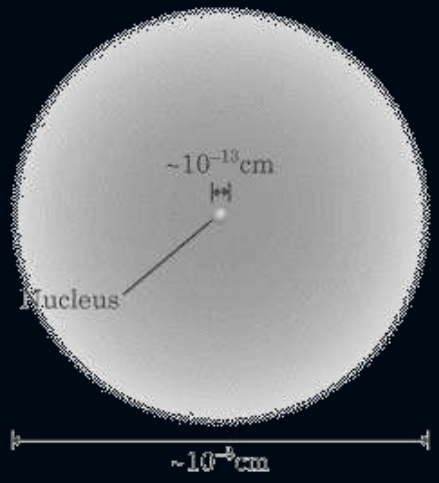
http://video.pbs.org/video/1511350366/

Element 114: **Flerovium**

Atomic Radii

The radius of an atomic nucleus is about 100 000 times smaller than the radius of an atom. Atomic radii are measured based on the greatest distance from the nucleus that an e^- belonging to the atom could be found.





Bell work
13-Oct-15

Which isotope is the most abundant of Palladium?

^{93}Pd ^{95}Pd ^{99}Pd ^{103}Pd

^{107}Pd ^{110}Pd ^{116}Pd ^{119}Pd

Explain why?

EQ: Is there value in going back to your failures and recompleting them to success even when you do not receive the initial award? Why?

Model average atomic mass concept then connect it to the calculations.

Turn In, 13.Oct.2015

Atomic Symbol Practice

Biennium Lab

Complete on a separate sheet of paper.
You need objective, data table, calculations

Don't lose the isotope or mix them up.

Follow instructions to the letter, remember, this is written at an entry level.

If there is a "half" isotope count it as a whole.

Bell Work
14-Oct-2015

What is another name for the phase change of solid to liquid besides melting?

Recalling the Beanium lab, what does percent abundance mean?

objective

You will calculate average atomic masses and be able to explain what an isotope is

EQ: Is there value in going back to your failures and recompleting them to success even when you do not receive the initial award? Why?

Beanium and Recall

What should you not drop on the floor?

Where can you find a formula for each of the calculations?

What part of an atoms weight can very it's mass, what part must say constant to still be that atom?

Isotopes

Dalton was wrong about all elements of the same type being identical

Atoms of the same element *can* have different numbers of neutrons.

Thus, different mass numbers.

These are called isotopes.

Isotopes

Frederick Soddy (1877-1956) proposed the idea of isotopes in 1912

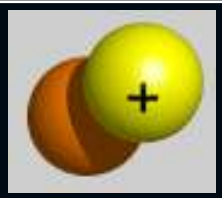
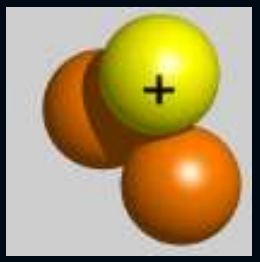
Isotopes are atoms of the same element having *different masses*, due to varying numbers of neutrons.

Naming Isotopes

We can also put the mass number *after* the name of the element:

- carbon-12
- carbon-14
- uranium-235

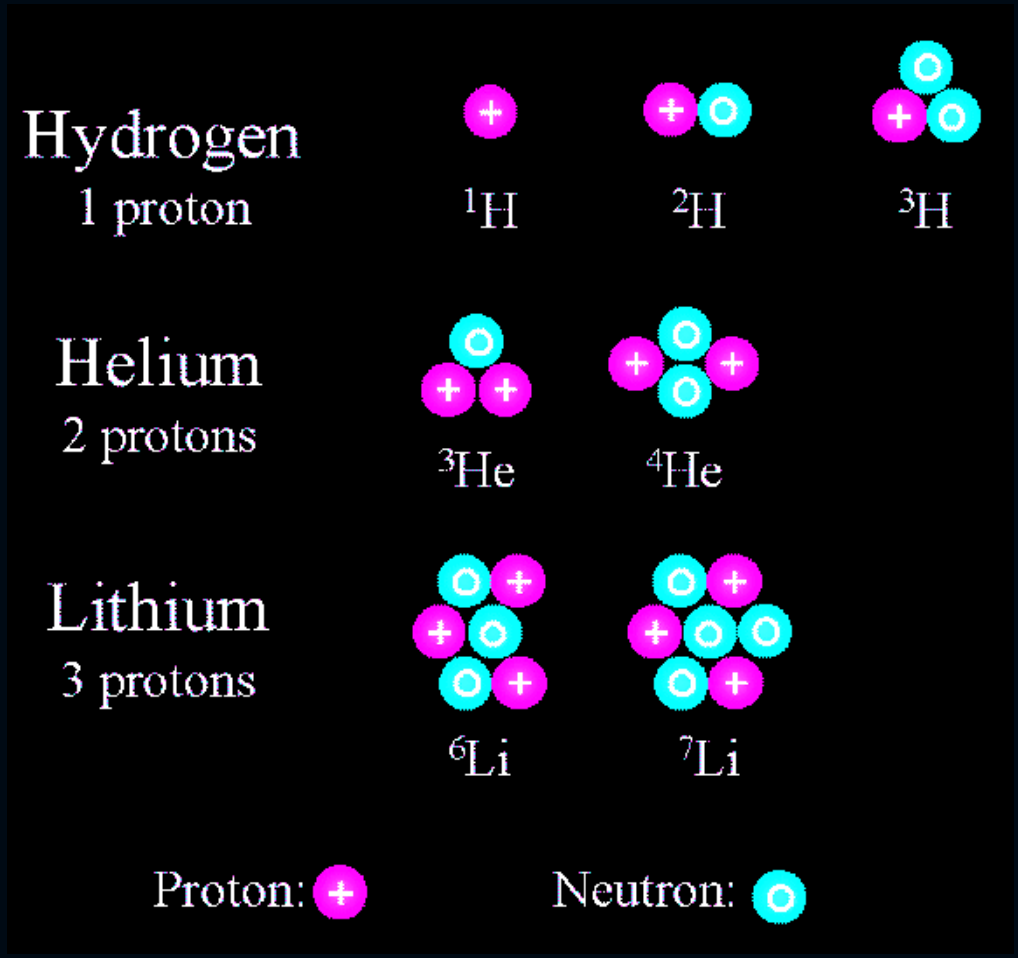
Isotopes are atoms of the **same element** having *different masses*, due to varying numbers of neutrons.

Isotope	Protons	Electrons	Neutrons	Nucleus
Hydrogen–1 (protium)	1	1	0	
Hydrogen-2 (deuterium)	1	1	1	
Hydrogen-3 (tritium)	1	1	2	

Isotopes

Elements occur in nature as *mixtures* of isotopes.

Isotopes are atoms of the same element that differ in the # *of neutrons*.



Atomic Mass

How heavy is an atom of oxygen?

- **It depends, because there are different *kinds* of oxygen atoms.**

We are more concerned with the *average atomic mass.*

This is based on the abundance (percentage) of each variety of that element in nature.

- **We don't use grams for this mass because the numbers would be too small.**

Measuring Atomic Mass

Instead of grams, the unit we use is the **Atomic Mass Unit** (amu)

It is defined as 1/12 the mass of a carbon-12 atom.

Carbon-12 chosen because of its isotope purity.

Each isotope has its own atomic mass, thus we determine the average from percent abundance.

To calculate the average:

Multiply the atomic mass of each isotope by it's abundance (expressed as a decimal), then add the results.

Average atomic mass =

Σ(mass of isotope × relative abundance)

Σ = summation: "Sum of all the parts"

If not told otherwise, the mass of the isotope is expressed in atomic mass units (amu)

Atomic Masses

Atomic mass is the average of all the naturally occurring isotopes of that element.

Isotope	Symbol	Composition of the nucleus	% in nature
Carbon-12	^{12}C	6 protons 6 neutrons	98.89%
Carbon-13	^{13}C	6 protons 7 neutrons	1.11%
Carbon-14	^{14}C	6 protons 8 neutrons	<0.01%

Carbon = 12.0125

Practice

Isotope name	**Isotope mass (amu)**	**percentage**
Silver-107	106.90509	51.86
Silver-109	108.90470	remainder

Average atomic mass of Ag =
(106.90509 × 0.5186)+(108.90470 × 0.4814) =
107.8677amu

Practice

There are two (2) different types (isotopes) of Cu atoms. The lighter isotope is more common with 69.09% of the naturally occurring Cu having a mass of 62.93 amu per atom. The remainder of the atoms, 30.91 %, have a mass of 64.94 amu. Find the AVERAGE ATOMIC MASS of the Cu atom.

Average atomic mass of copper =

(62.93 amu × 0.6909) + (64.94 amu × 0.3091)

= 63.55

Practice

What is the average atomic mass of the element Li if it's two (2) isotopes are ^{6}Li, 6.015amu with a percent abondances of 7.42% and ^{7}Li 7.016amu with a percent abondances of 92.58%?

#7

You need two equations since you have two unknowns:

$$100\% = a + b + c$$

And

Atomic Weight =

(a x avg Mass #1) + (b x avg Mass #2) + (c x avg Mass #3)

Closure

Write a short letter/ note to Mr. Brunenkant explaining what an isotope is, remember he most likely does not know